REMARKS:

Drawings

A Request for Approval of Proposed Drawing Changes is submitted herewith for consideration by the Examiner. The proposed changes correct the titles of the figures.

Specification Amendments

The specification has been amended to improve the grammar and to correct the titles of the figures.

Claim Amendments

Claims 2-29, 31-36, and 38-43 have been amended solely to improve the grammatical form thereof. These amendments are not necessitated by any prior art, and thus have no relation to the patentability of the invention as claimed in this application.

CONCLUSION:

Wherefore, in view of the foregoing amendments and remarks, this application is considered to be in condition for allowance, and an early reconsideration and a Notice of Allowance are earnestly solicited.

This Amendment does not increase the number of independent claims, does not increase the total number of claims, and does not present any multiple dependency claims. Accordingly, no fee based on the number or type of claims is currently due. However, if a fee, other than the issue fee, is due, please charge this fee to Sidley Austin Brown & Wood's Deposit Account No. 18-1260.

Any other fee required by this document pursuant to 37 C.F.R. §§ 1.16 and 1.17, other than the issue fee, and not submitted herewith should be charged to Sidley Austin Brown & Wood's Deposit Account No. 18-1260. Any refund should be credited to the same account.

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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

The following is a marked-up version of the changes to the specification and claims which are being made in the attached Preliminary Amendment.

IN THE ABSTRACT:

The paragraph on page 51.

[A liquid] Liquid crystal display apparatus [which] has [a] liquid crystal display and [a] controller. The [liquid crystal] display has [a plurality of] rectangular pixels arranged in a matrix, [a plurality of] with scanning electrodes extending [in the direction] parallel to [the] longer sides of [the rectangular] pixels, [a plurality of] and signal electrodes extending [in the direction] orthogonal to [the] longer sides of [the rectangular] pixels. [The controller is to drive the] Controller drives scanning electrodes and [the] signal electrodes. An image is written on the [liquid crystal] display by using a driving pulse for carrying out writing after resetting [the] liquid crystal and by carrying out interlace scanning with one frame divided into [a] plurality of fields. [The] Vertical pixel pitch [in the vertical direction] is 1/n [(for example, 1/1.5)] of [the] horizontal pixel pitch, [in the horizontal direction.] If [the] vertical pixel pitch [in the vertical direction] is 1/1.5 of [the] horizontal pixel pitch, [in the horizontal direction,] display data [to be displayed on the liquid crystal display] are produced by allocating original image data for [two] pixels Y1' and Y2' to [three] pixels Y1, Y2 and Y3. [The liquid crystal display] Display may have [a] first [display] area and [a] second [display] area, and [the] widths and [the] pitch of [the] scanning electrodes in [the] second [display] area may [be, for example,] be 1/2 of those of [the] scanning electrodes in [the] first [display] area.

IN THE SPECIFICATION:

Paragraph [0009]:

[0009] A plurality of pixels are formed on the intersections [between] of the scanning electrodes and the signal electrodes. Each of the pixels is substantially a rectangle [of which] with shorter sides which are parallel to the first direction and [of which] with longer sides which are parallel to the second direction.

Paragraph [0019]:

[0019] These and other objects and features of the present invention will be apparent from the following description with reference to the accompanying drawings, in which:

Fig. 1 is a sectional view of a liquid crystal display which is employed in a first embodiment of a liquid crystal display apparatus according to the present invention;

Fig. 2 is a block diagram which shows a driving circuit of the liquid crystal display;

[Fig. 3 show a] Figs. 3a and 3b show first and [a] second exemplary pixel structures according to the first embodiment;

Fig. 4 is a chart which shows driving waveforms in a first example of a driving method;

Fig. 5 is a chart which shows driving waveforms in a second example of the driving method;

Fig. 6 is a chart which shows a first example of interlace scanning;

Fig. 7 is a chart which shows writing on a pixel;

[Fig. 8 shows] Figs. 8a and 8b show original image data and a display which is made by executing the first example of interlace scanning;

[Fig. 9 shows] Figs. 9a-9c show processes of writing by executing the first example of interlace scanning;

Fig. 10 shows a scroll display made by executing the first example of

interlace scanning;

Fig. 11 is a chart which shows a second example of interlace scanning;

Fig. 12 shows a display of original image data shown by Fig. 8a which is made by executing the second example of interlace scanning;

Fig. 13 is a block diagram which shows a driving circuit in a second embodiment of the present invention;

[Fig. 14 shows] Figs. 14a-14c show pixel structures, Fig. 14a being a chart which shows a pixel structure according to the second embodiment, Fig. 14b being a chart which shows the pixel structure of original image data and Fig. 14c being a chart which shows the pixel structure of one unit according to the second embodiment;

[Fig. 15 shows] Figs. 15a-15c show a first way of allocating data to each pixel according to the second embodiment, Fig. 15a showing an original image, Fig. 15b being a chart which shows image data in a magnified part of the original image, and Fig. 15c being a chart which shows a state wherein data shown by Fig. 15b are allocated for the pixel structure according to the second embodiment;

[Fig. 16 shows] Figs. 16a-16c show a second way of allocating data to each pixel according to the second embodiment, Fig. 16a being a chart which shows original data; Fig. 16b being a chart which shows a state wherein the original data are allocated for the pixel structure according to the second embodiment, and Fig. 16c being a chart which shows a state wherein the original data are allocated for the pixel structure according to the second embodiment by using a letter font;

[Fig. 17 illustrates] Figs. 17a-17d illustrate the principle of operation of a driving IC, Figs. 17a, 17b and 17c being block diagrams of a shift register and Fig. 17d being a block diagram of an averaging circuit;

[Fig. 18 shows] Figs. 18a and 18b show driving ICs, Fig. 18a being a block diagram which shows an exemplary structure of a driving IC and Fig. 18b being a block diagram which shows a state wherein driving ICs are in cascade connection with each other;

Fig. 19 is a chart which shows a third example of interlace scanning;

[Fig. 20 shows] Figs. 20a-20c show processes of writing an image by executing the third example of interlace scanning;

Fig. 21 is a chart which shows a fourth example of interlace scanning;

[Fig. 22 shows] Figs. 22a and 22b show processes of writing by executing the fourth example of interlace scanning;

Fig. 23 is a block diagram which shows a driving circuit according to a third embodiment;

[Fig. 24 shows] Figs. 24a and 24b show a first exemplary pixel structure and a second exemplary pixel structure according to the third embodiment;

Fig. 25 is an illustration of a first exemplary arrangement of driving ICs;

Fig. 26 is an illustration of a second exemplary arrangement of driving ICs;

Fig. 27 is a chart which shows a fifth example of interlace scanning;

[Fig. 28 shows] Figs. 28a-28c show a comparative example, Fig. 28a showing original image data and Figs, 28b and 28c showing processes of writing the image data on square pixels by executing the fifth example of interlace scanning;

[Fig. 29 shows] Figs. 29a-29c show allocation of the original image data for the pixel structure according to the third embodiment and processes of writing the data by executing the fifth example of interlace scanning;

Fig. 30 is a chart which shows a sixth example of interlace scanning;

Fig. 31 is a chart which shows a seventh example of interlace scanning;

[Fig. 32 shows] Figs. 32a-32c show processes of writing based on the original image data by executing the sixth example of interlace scanning;

Fig. 33 is a block diagram which shows a modification of the driving circuit of the third embodiment; and

Fig. 34 shows exemplary processes of writing still pictures and motion pictures.

Paragraph [0023]:

[0023] Each of the display layers 111R, 111G and 111B has, between transparent substrates 112 on which transparent electrodes 113 and 114 are formed, resin columnar nodules 115, liquid crystal 116 and spacers 117. On the transparent electrodes 113 and 114, an insulating layer 118 and an alignment controlling layer 119 are provided, if necessary. Around the transparent substrates 112 (out of a displaying area), a sealant 120 is provided to seal the liquid crystal 116 therein.

The heading between paragraph [0035] and paragraph [0036]:

Pixel Structure; See [Fig. 3] Figs. 3a and 3b

Paragraph [0066]:

[0066] [Fig. 9 shows] Figs. 9a-9c show processes of writing an image by carrying out the first exemplary interlace scanning. Fig. 9a shows a state of carrying out writing in the odd-number field, and Fig. 9b shows a state of carrying out writing in the even-number field. For example, if the length of the selection step is 0.1ms to 0.5ms, and if the length of the reset step and the length of the evolution step are around 25msec, writing can be carried out at a rate of about 10 frames per second, although the rate also depends on the number of scanning lines. Accordingly, as Fig. 9c shows, the observer sees no blackouts on the screen.

Paragraph [0068]:

[0068] This second example, like the first example, is mainly to avoid a flicker. [One] In Fig. 11, one frame is divided into three fields, and the evolution step of each scanning line in a field is extended to the start of writing on each scanning line in the next field. With this extension, the ratio

of the pixels in a blackout state to the pixels in a display state is almost constant, and the brightness of the screen is almost constant.

The heading between paragraph [0071] and paragraph [0072]:

Pixel Structure; See [Fig. 14] Figs. 14a-14c

Paragraph [0072]:

[0072] [Fig. 14 shows] Figs. 14a-14c show the pixel structure of the second embodiment. In the pixel structure, as Fig. 14a shows, the widths of the scanning electrodes R1 through Rm are smaller than the widths of the signal electrodes C1 through Cn, and accordingly, the respective pixels LR1-C1 through LRm-Cn are rectangular. The scanning electrodes extend along the longer sides of the pixels, and the signal electrodes extend in a direction substantially orthogonal to the longer sides of the pixels.

The heading between paragraph [0076] and paragraph [0077]:

Display Data; See [Figs. 15 and 16] Figs. 15a-15c and Figs. 16a-16c

Paragraph [0078]:

[0078] [Fig. 16 shows] Figs. 16a-16c show a second display method. In the second method, data in the original pixel Y1' and data in the original pixel Y2' are displayed in the pixel Y1 and in the pixel Y3 respectively, and the data with a higher density of the data in the pixel Y1 and the data in the pixel Y3 are displayed in the middle pixel Y2. Fig. 16a shows original data, and Fig. 16b shows a display which is made by allocating the original data to the pixels by the second method. This second display method is suited when original data are text data.

The heading between paragraph [0082] and paragraph [0083]:

Operation and Structure of Driving ICs; See [Figs. 17 and 18] Figs. 17a-17d and 18a-18b

Paragraph [0083]:

[0083] [Fig. 17 shows] Figs. 17a-17d show the principle of operation of the signal electrode driving IC 132 when the first display method is carried out.

The heading between paragraph [0089] and paragraph [0090]:

Scanning Example 3; See [Figs. 19 and 20] Figs. 19 and 20a-20c

Paragraph [0091]:

[0091] [Fig. 20 illustrates] Figs. 20a-20c illustrate processes of writing the image shown by Fig. 15c by executing the third scanning example. Fig. 20a shows a state in which writing is carried out in the first field; Fig. 20b shows a state in which writing is carried out in the second field; and Fig. 20c shows a state in which writing is carried out in the third field.

The heading between paragraph [0091] and [0092]:

Scanning Example 4; See [Figs. 21 and 22] Figs. 21, 22a, and 22b

Paragraph [0093]:

[0093] [Fig. 22 illustrates] Figs. 22a and 22b illustrate processes of writing the image shown by Fig. 15c by executing the fourth scanning example. Fig. 22a shows a state in which writing is carried out in the odd-number field; and Fig. 22b shows a state in which writing is carried out in the even-number field.

The heading between paragraph [0100] and paragraph [0101]:

Pixel Structure; See [Fig. 24] Figs. 24a and 24b

Paragraph [0105]:

[0105] A plurality of scanning electrode driving ICs, each of which is to drive a plurality of scanning electrodes, may be provided, and [A] a plurality of signal electrode driving ICs, each of which is to drive a plurality of signal electrodes, may be provided. Fig. 25 shows a first exemplary arrangement of the driving ICs, and Fig. 26 shows a second exemplary arrangement of the driving ICs. In the first example, all the scanning electrode driving ICs are arranged at one side of the display areas 11 and 12. In the second example, for the second display area 12 in which the scanning electrodes are aligned at a smaller pitch, the scanning electrode driving ICs 131 are arranged at both sides. For example, the scanning electrode driving ICs 131 for driving the scanning lines of even numbers are arranged at the right side, and the scanning electrode driving ICs 131 for driving the scanning lines of odd numbers are arranged at the left side. When the liquid crystal display is of a small size, only one scanning electrode driving IC 131 and one signal electrode driving IC 132 may be provided.

The heading between paragraph [0107] and paragraph [0108]:

Scanning Example 5; See [Figs. 27, 28 and 29] Figs. 27, 28a-28c, and 29a-29c

Paragraph [0112]:

[0112] [Fig. 29 shows] Figs. 29a-29c show a case of allocating the original image data shown by Fig. 28a to be displayed in the second display area 12 in which the scanning electrodes are arranged at a half pitch. By allocating the original image data in the way shown by Fig. 29a and by performing writing by the fifth scanning example, as Figs. 29b and 29c show, during the writing,

omission of original image data is inhibited, and the image is easily recognizable.

The heading between paragraph [0114] and paragraph [0115]:

Scanning Examples 6 and 7; See Figs. 30, [31 and 32] 31, and 32a-32c

Paragraph [0116]:

[0116] [Fig. 32 shows] Figs. 32a-32c show processes of writing an image by the sixth scanning example, and the original image data to be displayed are shown by Fig. 28a. Since the resolution of the scanning lines is higher than that in the fifth scanning example, a smoother image with a higher resolution can be displayed.

The heading between paragraph [0118] and paragraph [0119]:

Writing of Still Picture and Writing of Motion Picture; See Figs. [34] 34a-34c

IN THE CLAIMS:

2. (Once Amended) [The] A liquid crystal display apparatus according to claim 1, wherein:

pixels are formed at intersections of the first scanning electrodes and the signal electrodes; and

each of the pixels is a rectangle [of which] having shorter sides which are parallel to the first direction and [of which] having longer sides which are parallel to the second direction.

3. (Once Amended) [The] A liquid crystal display apparatus according to claim 2, wherein:

a width of each of the first scanning electrodes defines a length of the shorter sides of each of the pixels; and

a width of each of the signal electrodes defines a length of the longer sides of each of the pixels.

4. (Once Amended) [The] A liquid crystal display apparatus according to claim 1, wherein the first pitch is 1/n of the second pitch, wherein n is a natural number not less than 2.

5. (Once Amended) [The] A liquid crystal display apparatus according to claim 4, wherein n is 2.

6. (Once Amended) [The] A liquid crystal display apparatus according to claim 1, wherein the first pitch is 1/n of the second pitch, wherein n is a number more than 1 and less than 2.

7. (Once Amended) [The] A liquid crystal display apparatus according to claim 6, further comprising:

a scanning electrode driver which is connected to the first scanning electrodes so as to apply voltages thereto;

a signal electrode driver which is connected to the signal electrodes so as to apply voltages thereto; and

a controller which is connected to the scanning electrode driver and the signal electrode driver so as to control the scanning electrode driver and the signal electrode driver.

8. (Once Amended) [The] A liquid crystal display according to claim 7, wherein the controller produces display data from original image data by carrying out an interpolation of the original image data with respect to the second direction and controls the scanning electrode driver and the signal electrode driver in accordance with the display data.

9. (Once Amended) [The] A liquid crystal display according to claim 8, wherein a number of lines in the second direction of the display data is n times a number of lines in the second direction of the original image data.

10. (Once Amended) [The] A liquid crystal display apparatus according to claim 9, wherein n is 1.5.

11. (Once Amended) [The] A liquid crystal display apparatus according to claim 10, wherein the controller produces display data for pixels on one scanning line from original image data for pixels on two successive scanning lines.

12. (Once Amended) [The] A liquid crystal display apparatus according to claim 11, wherein the controller produces display data for pixels on one scanning line by averaging image data for pixels on two successive scanning lines.

13. (Once Amended) [The] A liquid crystal display apparatus according to claim 11, wherein the controller produces display data for pixels on one scanning line by comparing original image data for pixels on two successive scanning lines.

14. (Once Amended) [The] A liquid crystal display apparatus according to claim 7, further comprising:

a memory for storing font data which are exclusively used in the liquid crystal display apparatus,

wherein the controller uses the font data in a case where the original image data contains text data.

15. (Once Amended) [The] A liquid crystal display apparatus according to claim 1, further comprising:

a plurality of second scanning electrodes aligned in the first direction at a third pitch wider than the first pitch, each of the second scanning electrodes extending in the second direction.

16. (Once Amended) [The] A liquid crystal display apparatus according to claim 15, further comprising:

a scanning electrode driver which is connected to the first scanning electrodes and the second scanning electrodes so as to apply voltages thereto;

a signal electrode driver which is connected to the signal electrodes so as to

apply voltages thereto; and

a controller which is connected to the scanning electrode driver and the signal electrode driver so as to control the scanning electrode driver and the signal electrode driver.

17. (Once Amended) [The] A liquid crystal display apparatus according to claim 16, wherein the controller controls the scanning electrode driver and the signal electrode driver to scan the second scanning electrodes by interlace scanning.

18. (Once Amended) [The] A liquid crystal display apparatus according to claim 16, wherein the controller controls the scanning electrode driver and the signal electrode driver to scan the first scanning electrodes in order of the alignment thereof.

19. (Once Amended) [The] A liquid crystal display apparatus according to claim 16, wherein the scanning electrode driver comprises:

at least one first driver IC which is connected to some of the first scanning electrodes and which is located at a first end of the first scanning electrodes with respect to the second direction;

at least one second driver IC which is connected to [the] others of the first scanning electrodes and which is located at a second end, which is opposite to the first end, of the first scanning electrodes; and

at least one third driver IC which is connected to the second scanning electrodes and which is located at the first end.

20. (Once Amended) [The] A liquid crystal display according to claim 15, wherein the signal electrodes are shared to be coupled with the first scanning electrodes and the second scanning electrodes.

21. (Once Amended) [The] A liquid crystal display apparatus according to claim 15, wherein the signal electrodes comprise:

a plurality of first signal electrodes which are coupled with the first scanning electrodes; and

a plurality of second signal electrodes which are coupled with the second scanning electrodes.

22. (Once Amended) [The] A liquid crystal display apparatus according to claim 21, further comprising:

at least one first driver IC which is connected to the first signal electrodes and which is located at a first end of the first and second signal electrodes with respect to the first direction; and

at least one second driver IC which is connected to the second signal electrodes and which is located at a second end, which is opposite to the first end, of the first and second signal electrodes.

23. (Once Amended) [The] A liquid crystal display apparatus according to claim 15, wherein the first pitch is 1/n of the second pitch, wherein n is a natural number not less than 2.

24. (Once Amended) [The] A liquid crystal display apparatus according to claim 23, further comprising:

a scanning electrode driver which is connected to the first scanning electrodes and the second scanning electrodes so as to apply voltages thereto;

a signal electrode driver which is connected to the first signal electrodes so as to apply voltages thereto; and

a controller which is connected to the scanning electrode driver and to the signal electrode driver so as to control the scanning electrode driver and the signal electrode driver.

25. (Once Amended) [The] A liquid crystal display apparatus according to claim 24, wherein the controller controls the scanning electrode driver and the signal electrode driver to reset the liquid crystal of the liquid crystal layer and then to write an image by interlace scanning.

26. (Once Amended) [The] A liquid crystal display apparatus according to claim 25, wherein:

in carrying out the interlace scanning, a frame is divided into n fields, wherein n is a natural number not less than 2; and

the first pitch is 1/n of the second pitch.

27. (Once Amended) [The] A liquid crystal display apparatus according to claim 1, wherein the liquid crystal has a memory effect.

28. (Once Amended) [The] A liquid crystal display apparatus according to claim 27, wherein the liquid crystal exhibits a cholesteric phase.

29. (Once Amended) [The] A liquid crystal display apparatus according to claim 28, wherein the liquid crystal comprises a nematic liquid crystal compound and a chiral agent.

31. (Once Amended) [The] A liquid crystal display apparatus according to claim 30, wherein n is 1.5

32. (Once Amended) [The] A liquid crystal display apparatus according to claim 30, wherein the first pitch is 1/n of the second pitch.

33. (Once Amended) [The] A liquid crystal display apparatus according to claim 32, wherein n is 1.5.

34. (Once Amended) [The] A liquid crystal display apparatus according to claim 30, wherein the liquid crystal has a memory effect.

35. (Once Amended) [The] A liquid crystal display apparatus according to claim 34, wherein the liquid crystal exhibits a cholesteric phase.

36. (Once Amended) [The] A liquid crystal display apparatus according to claim 35, wherein the liquid crystal comprises a nematic liquid crystal compound and a chiral agent.

38. (Once Amended) [The] A liquid crystal display apparatus according to claim 37, wherein the signal electrodes comprise:

a plurality of first signal electrodes which are coupled with the first scanning electrodes; and

a plurality of second signal electrodes which are coupled with the second scanning electrodes.

39. (Once Amended) [The] A liquid crystal display apparatus according to claim 37, wherein the signal electrodes are shared to be coupled with the first scanning electrodes and the second scanning electrodes.

40. (Once Amended) [The] A liquid crystal display apparatus according to claim 37, wherein the first pitch is 1/n of the second pitch, wherein n is a natural number not less than 2.

41. (Once Amended) [The] A liquid crystal display apparatus according to claim 37, wherein the liquid crystal has a memory effect.

42. (Once Amended) [The] A liquid crystal display apparatus according to claim 41, wherein the liquid crystal exhibits a cholestric phase.

43. (Once Amended) [The] A liquid crystal display apparatus according to claim 42, wherein the liquid crystal comprises a nematic liquid crystal compound and a chiral agent.